

The NDT detection of knobs' shape by video treatment technique

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Abstract: The NDT detection of knobs of logs and timbers was conducted by using computer video technique. The key detection points were taken from these knobs for mathematics description. It can make the drawing of these knobs quantitatively and establish corresponding mathematics models. Using the grayness of pictures and cartoon treatment made the mathematics reappearance of the knobs become more access to video pictures.

Keyword: Knob, Video treatment, NDT Detection

Introduction ¹

With automation of timber processing and the increasing needs for batch product of the integrated lumbers, such as superior quality woods, the automatic discern of the timber knobs becomes more important. In the process of the integrated lumbers in China, sometimes the timbers with knobs on their back or no knob on right sides could not be distinguished by using artificial discern, which made the integrated timber reduce to a lower rank. Knobs are the natural drawback due to the branches' growing. There hardly exist timbers without knobs. Knobs would affect the texture, beauties, intensity and toughness of timber. Leaving out the knobs, as well as forming the integrated lumber by putting it together, is the best model of superior quality timbers at present. Classifying the hygiene chopsticks and bat of ice cream by the artificial selection can not guarantee the quality, but waste lots of manpower. Consequently, study of theories of the knobs' video selection has great value on industry

The NDT detection method

Three industrial pickup cameras were used to take pictures of the three sides of the log knobs. A_1 , A_2 and A_3 in Fig. 1 stand for three pickup cameras. The knobs of boards were detected by two pickup cameras. A_1 and A_2 in Fig. 2 stand for two pickup cameras. The shapes of knobs can be analyzed with these pictures. All of that provide theoretic foundation for the knobs' mathematics description.

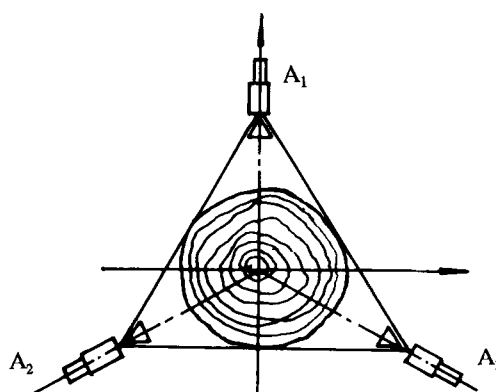


Fig. 1. The detection way of the log knobs

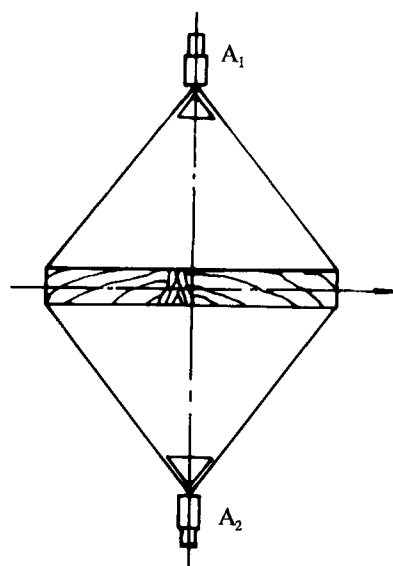


Fig. 2. The detection way of board knobs

Selection of detection points of log knobs

For a mechanism of the log knobs, when using two industrial pickup cameras to detect, it should make the log pass through the two pickup cameras by combining the movement of the logs with shift in axle direction. And when using three or four pickup cameras, the logs only need to be moved rectilinearly. When the logs passed a given position of the pickup cameras, the cameras, A_1 , A_2 and A_3 , would take pictures as shown in Fig. 3.

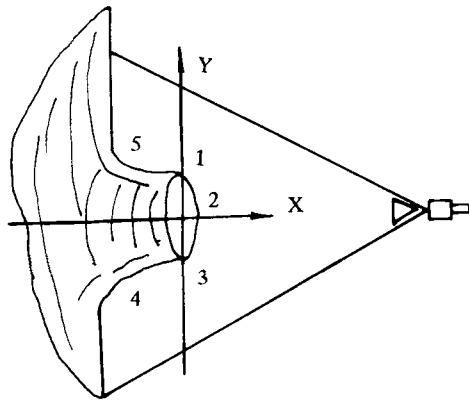


Fig. 3. The picture of the detection of the log knobs

According to the need of the knobs' mathematics description, five points at least would be detected out for each knob. The distribution of the five points should meet the following hypothesis.

In the plane in X direction nearest to the pickup cameras, point 1 is the biggest point in Y direction, and point 2, a middle outer point between point 1 and point 3, is the smallest point.

Point 4, the biggest point in the Y direction, is in the place with biggest twist rate towards to the texture part of the logs.

Point 5, the smallest point in the Y direction, is in the place with biggest twist rate towards to the texture part of the logs.

According to above detection, a set of pictures would be formed at anytime that the logs move. Every set of pictures becomes a set of data. If every set of data could go back to the approximate shape of knob by interpreting some data, then the dynamics pictures could be formed.

Selection of detection points of board knobs

The knobs' shape detection of board is simpler than that of log. Figure 4 shows the shape of two sides of knob.

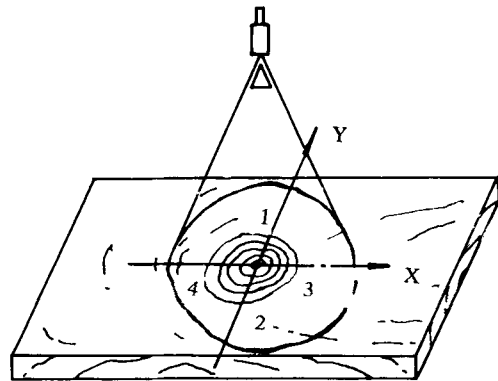


Fig. 4. The selection way of the board knobs

The detection mechanism of the board knobs is composed of two pickup cameras, in charge of taking pictures of the shapes for each side of the knob. Since the cameras are vertical to the plane that the knob located, the taken pictures are the real imagines. Four points should be selected for detection of knobs of board.

Point 1 is the biggest point in Y direction.

Point 2 is the smallest point in Y direction.

Point 3 is the biggest point in X direction.

Point 4 is the smallest point in X direction.

The industrial value of the board detection is tremendous. The board detection in the world usually take the industrial CT as a tool. At present, the investment in the industrial CT is near 100 times that in the industrial pickup cameras. Therefore, to develop the video detection technique of the board knobs would have widely popular prospect.

Video treatment of detection points

The picture that taken by industrial pickup cameras is a digit picture, which can only describes the shape of the knobs. So the selection of the representative points need the support by video treatment technique. After getting the pictures, firstly, they were treated on grayness for making the edges of picture deeper, the middle part lighter, protruding the outer outline of the pictures, and getting cartoon results. On the base of the cartoon pictures, the given points were selected from the fixed video detection points by the principle motioned above.

Video treatment of a digit picture needs to filter wave from picture and to eliminate the unnecessary disturbances. In this process, there exists the effect of the stains, gap, scar, and double layer, etc.. So how to remove these influences needs some special experiences and skills. When doing with them, we should combine the physics discern and video

discern with mathematics models to raise the discern rate up to above 98%. This discerns rate can completely meet with the need for the technique of the knobs' industrial discerns.

The automatic points' selection by computer is also not easy after treatment of pictures. Firstly, the knobs should be defined at one coordinate system, but there are lots of theory work should be done for determining the coordinate center of a circle. Especially the automatic selection of the center of circle is very difficult. So after the cartoon treatment the points would be selected in equal distance on the edge of the circle. Then mathematics regression was made for the inner circle of the knobs' outer outline to find out the center of the circle. At last, according to the above principles, the points needed were selected from the center of the circle as a circle point

Conclusion

The selection methods used for the mathematics description of the knobs' NDT can make the description of the knobs become quantitative and analytic. The cartoon treatment technique can make the video description of knobs vividly.

The methods of the board knobs' NDT description have a certain industrial value.

The video description method of the knobs' NDT provide the theory basic for the mathematics

description and can make the description of knob realize dynamic imitation.

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